Method for conducting a cooking process using a cooking process probe

Description

The invention relates to a method for conducting a cooking process in a cooking chamber of a cooking appliance using a cooking process probe which is to be inserted at least partly into an item being cooked in the cooking chamber for detecting at least one variable of the item being cooked, in which method non-insertion of the cooking process probe into the item being cooked is detected and, if non-insertion is detected, at least a first warning signal is emitted, a changeover is made to an emergency program and/or the cooking program is aborted; and it relates to a cooking appliance for carrying out said method.

An increasing number of cooking process probes are being used for conducting a cooking process. A cooking process probe is known for example from DE 299 23 215.8. To allow the possibilities of conducting a cooking process that are mentioned there to be fully exploited, it is a pre-requisite that the cooking process probe is actually inserted in the item being cooked. This is so because, if the cooking process probe is outside the item being cooked, the cooking result may be made considerably worse, since the cooking process probe does not pick up any actual information on the item being cooked. The problems of detecting non-insertion are already discussed in DE 100 61 821.9-34, which is not a prepublished publication. In that case, temperature profiles detected by the sensors of the cooking process probe are evaluated, which does lead to satisfactory results but requires complicated software.

Further methods for detecting improper use of a cooking process probe are known from the prior art. For instance, a control device for cooking, roasting or baking processes with a food thermometer is known from DE 31 04 926 C2. This food thermometer comprises not only a sensor part having a temperature sensor but also an indicating device, by means of which the resistance of an item being cooked is measured and compared with a predefined reference value. If in this case the difference between the measured resistance value and the reference value exceeds a predefined threshold value, the conclusion is drawn that the cooking process probe is not in the item being cooked, and the cooking process is aborted. However, a disadvantage of the method used in this device is that false indications may occur. For instance, soiling of the indicating device may have the effect that the difference between the measured resistance value and the reference value lies below the predefined threshold value although the temperature sensor is not inside an item being cooked. This can lead to an undesired cooking result.

Furthermore, there are known cooking appliances in which miss-insertion of a cooking process probe is detected by a temperature measured by means of the cooking process probe being compared with a temperature prevailing in a cooking chamber. If the difference between these two measured temperatures lies below a predefined value, it is assumed that the cooking process probe has not been inserted correctly into the item being cooked. However, a disadvantage of the method used in these cooking appliances is that, in the case of a delta measurement, i.e. correction of the cooking chamber temperature on the basis of the temperature recorded by means of the cooking process probe, miss-insertion of the cooking process probe is possibly not detected.

Finally, on the market there are also appliances for treating items being cooked which use a cooking process probe with its socket for connecting the cable to the cooking appliance arranged outside the cooking appliance. If the cooking process probe is not being used, the connector is closed by a cover. A cooking process with a cooking process probe line can only be started when the cooking process probe is connected to the cooking appliance via the connection. However, a disadvantage of these cooking appliances is that, in spite of the connection of the cooking process probe to a cooking appliance, a user can start the cooking process even if the cooking process probe has not been inserted into an item being cooked.

It is therefore the object of the present invention to develop the method of the generic type further in such a way that the disadvantages of the prior art are overcome. It is also intended to provide a cooking appliance which is improved in comparison with the prior art for carrying out such a method.

The object relating to the method is achieved according to the invention by providing that, to detect non-insertion of the cooking process probe, a monitoring is carried out to determine whether

- the cooking process probe is in a standby position in a retaining device provided by the cooking appliance,
- the cooking process probe has been removed from the retaining device,
- the cooking process probe is in a measuring position in a positioning device provided by an accessory part for receiving the item being cooked,
- the cooking process probe has been removed from the positioning device,
- the cooking process probe is positioned inside the cooking appliance,
- the cooking process probe has been moved, and/or

- the cooking process probe has been grasped.

In this respect, it may also be provided that, to detect non-insertion of the cooking process probe, a monitoring is carried out to determine whether the cooking process probe is connected to the cooking appliance.

A particularly advantageous alternative embodiment of the method is characterized in that, at at least one predetermined point in time, preferably determined by the beginning of a cooking process, the end of a cooking process and/or an actuation, in particular opening or closing, of a cooking chamber door, the monitoring to detect non-insertion of the cooking process probe proceeds automatically.

In the method, it may be provided in particular that, in an monitoring to detect non-insertion, at least a conductivity value, a resistance value, an induction value, a capacitance value, a potential difference value, a temperature value, a weight value, a moisture value, a radiation characteristic, a pressure characteristic and/or a characteristic of an electric, magnetic or electromagnetic field is or are detected, in particular over time and/or by forming time derivatives.

A further advantageous embodiment of the method provides that, to detect non-insertion of the cooking process probe, at least one variable of the item being cooked detected by means of the cooking process probe, a variation over time of the variable of the item being cooked and/or at least one derivative of the variation over time of the variable of the item being cooked is or are determined with respect to time, the determined variable of the item being cooked, the determined variation over time and/or the determined derivative

preferably being compared with at least one setpoint value.

Finally, it may be provided in the method that, dependent on the cooking process, a second warning signal is emitted if the cooking process probe is not placed in the retaining device, in order to call on an operator to place the cooking process probe in the retaining device, and/or a third warning signal is emitted if the cooking process probe is not placed in the positioning device, in order to call on an operator to place the cooking process probe in the positioning device.

The invention also relates to a cooking appliance for carrying out the method according to the invention, with at least one sensor for detecting non-insertion of the cooking process probe, in particular comprising electrical contacts, a contact sensor, a pressure sensor, a light barrier, an ultrasonic sensor, a reed contact, a locating system, preferably operating electromagnetically, a movement sensor, a light sensor, a conductivity sensor and/or a moisture sensor.

In this respect, it may be provided in particular that the sensor is comprised by the retaining device, the positioning device and/or the cooking process probe.

A cooking appliance according to the invention may also be characterized by an input and/or output unit and/or an open-loop and/or closed-loop control unit in operative connection with the cooking process probe, a cooking chamber door, the sensor, the retaining device and/or the positioning device.

It is advantageously provided that the cooking process probe is captively connected to the cooking appliance.

Finally, a particularly advantageous embodiment of the cooking appliance is characterized by a cooling device, at least temporarily in operative connection with the cooking process probe and/or the retaining device, for cooling of at least one region of the cooking process probe.

The invention is consequently based on the surprising finding that a method for detecting improper use of a cooking process probe, in particular non-insertion of the same into an item being cooked, can be carried out by being able to detect improper use at the beginning of a cooking process without a time delay, avoidance of detection by a user being at least made more difficult. In particular, use of the retaining device according to the invention for the cooking process probe in such a way that the application of a voltage or measurement of a conductivity value allows the determination of whether or not the cooking process probe is in the retainer, or has or has not been removed from it, makes such detection possible. In particular, comparison of the time of day of the removal and the start of the process at a time before or after it makes it possible for placement of the cooking process probe or omission of the same to be reliably assumed, and consequently improper use of the cooking process probe to be detected. In particular, the combination of various actions for handling the cooking process probe, not only detecting whether the cooking process probe has been removed from its holder, that is to say has been grasped, has been moved, has been positioned at any particular location and/or has been inserted into a cooking process probe holder of an accessory part, makes it possible for improper use of the cooking process probe to be detected essentially reliably.

Further features and advantages of the invention emerge from the description which follows, in which preferred

embodiments of the invention are explained in detail by way of example on the basis of schematic drawings, in which:

Figure 1 shows a cooking appliance according to the invention;

Figure 2 shows a first embodiment according to the invention of a retaining device for a cooking process probe as part of the cooking appliance of Figure 1;

Figure 3 shows a second embodiment of a retaining device according to the invention;

Figure 4 shows a third embodiment of a retaining device according to the invention;

Figure 5 shows a fourth embodiment of a retaining device according to the invention;

Figure 6 shows a fifth embodiment of a retaining device according to the invention; and

Figure 7 shows a cooking process probe for the cooking appliance of Figure 1.

Represented in Figure 1 is a cooking appliance 1 according to the invention with a cooking chamber 3, which can be closed by means of a cooking chamber door 5. Furthermore, the cooking appliance 1 comprises an input unit 7, by means of which a user can operate the cooking appliance 1. In particular, by means of the input unit 7, a user can program, start or end a cooking process or alter individual cooking parameters during a cooking process. By means of an output unit 9, information on the cooking appliance 1, an item being cooked and/or a cooking process can be given to a

user. For this purpose, the output unit 9 comprises a display for indicating cooking parameters and/or an acoustic output unit for producing warning and/or information signals. The cooking appliance 1 also comprises a cooking process probe 11, which is captively connected by means of a cable 19 to the cooking appliance 1, in the cooking chamber 3. This connection prevents the cooking process probe 11 from being removed from the cooking appliance 1 during normal operation. To carry out a cooking process, the cooking process probe 11 is inserted into an item being cooked 13, such as a roast joint, in particular to pick up at least a core temperature and, if appropriate, a surface temperature of the item being cooked 13, these temperature values being used for controlling the subsequent cooking process. If needed, positioning of the cooking process probe 11 may take place by means of a positioning device 15, which can for example be fixedly connected to an accessory part 16 in the form of a metal sheet for carrying the item being cooked 13. If the cooking process probe 11 is not used, in particular if no cooking process is being carried out, it can be deposited by a user in a standby position in a retaining device 17 fixedly connected to the cooking chamber 3. The position of the cooking process probe 11 in the retaining device 17 is presented by dashed lines in Figure 1.

Although in Figure 1 the retaining device 17 is represented inside the cooking chamber 3, and the cooking process probe is connected to the cooking appliance 1 by means of a cable 19, the retaining device may be arranged at any desired position of the cooking appliance and the cooking process probe may be wirelessly connected to the cooking appliance for the transmission of data on the item being cooked. The captivity of the cooking process probe is achieved by a warning sound being emitted from the output unit when

the cooking process probe is removed from the cooking appliance.

The cooking appliance 1 also comprises a closed-loop control unit (not represented), by means of which it is possible, inter alia, to control a cooking process carried out in the cooking appliance 1. This control of the cooking process also comprises the method according to the invention, by which improper use of the cooking process probe can be detected. In this respect, it is taken into account that, when carrying out a cooking process with the cooking process probe 11, a user should perform essentially predetermined actions on the cooking appliance 1, in particular on the cooking process probe 11. This is so because, before the beginning of a cooking process, a user should firstly open the cooking chamber door 5 and position the item being cooked 13 inside the cooking chamber 3. Subsequently, the user should remove the cooking process probe 11 from the retaining device 17 and insert it in the item being cooked 13, in particular by means of the positioning device 15. Subsequently, the user should close the cooking chamber 3 by means of the cooking chamber door 5 and start the cooking process by means of the input 7, if appropriate after a time delay. During the subsequent cooking process, the cooking process probe 11 should remain essentially stationary in the item being cooked 13 and only once the cooking process has ended and the cooking chamber door 5 is opened should it be grasped by the user, if appropriate removed from the positioning device 15 and inserted into the retaining device 17. If these desired actions for handling the cooking process probe do not take place during a cooking process, poor or even harmful cooking results may occur.

The method according to the invention now offers the possibility of detecting when at least one desired action for handling the cooking process probe that is necessary for its proper use does not take place or it is mishandled, and of reacting to this, such as by emitting warning signals, changing over to an emergency program or aborting a cooking process.

A first desired action for handling the cooking process probe 11 is for example to remove the cooking process probe 11 from the retaining device 17, which of course presupposes that the cooking process probe 11 is in the retaining device 17 in the first place. If, however, the cooking process probe 11 is still in the retaining device 17 at the beginning of a cooking process, improper use of the cooking process probe 11 can always be directly concluded. Furthermore, improper use of the cooking process probe 11 can also be concluded for example if removal of the cooking process probe 11 from the retaining device 17 has taken place outside a specific time period before the beginning of the cooking process or the programming of the cooking process or the closing of the cooking chamber door 5. In such a case, it must be assumed that the cooking process probe 11 has not been inserted into the item being cooked 13.

Represented in Figure 2 is a first embodiment according to the invention of a retaining device 17'. The retaining device 17' is fixedly attached to a cooking appliance wall 20 and comprises two fork-shaped holders 21, 23, which are designed as clips for receiving the cooking process probe 11. At least the surface regions of the holders 21, 23 which come into contact with the cooking process probe 11 (not shown) when it is inserted consist of a conductive material and consequently form contacts 25 and 27, respectively. The remaining regions of the holders 21 and 23 are

preferably electrically insulated on the outside. The contacts 25 and 27 are connected to the closed-loop control unit via lines 29 and 31 in such a way that the contact 25 is at a potential of, for example, 12 volts, while the contact 27 is at a potential of, for example, 5 volts or ground. If the cooking process probe 11 is not in the retaining device 17, as represented, no current flow occurs between the contacts 25 and 27. Consequently, it can be concluded from the absence of a current flow between the contacts 25 and 27 that the cooking process probe 11 is not located inside the retaining device 17. If, on the other hand, the cooking process probe 11 is introduced into the holders 21 and 23 of the retaining device 17, a current flow between the contacts 25 and 27 occurs via the conductive surface of the cooking process probe 11.

Represented in Figure 3 is a second retaining device 32 according to the invention. By contrast with the first retaining device 17', represented in Figure 2, the second retaining device 32 comprises two annular holders 21' and 23', respectively. These in turn comprise contacts 25' and 27', respectively, which are connected to the closed-loop control unit via the lines 29 and 31. By contrast with the first retaining device 17' represented in Figure 2, the cooking process probe 11 cannot be clipped into the second retaining device 32, but must firstly be passed from above through the holder 21' and with the tip through the holder 23'. The contacts 25' and 27' are at different potentials, so that presence of the cooking process probe 11 in the retaining device 32 can be concluded from a current flow between the contacts 25' and 27' via the surface of the cooking process probe 11.

Represented in Figure 4 is a third retaining device 33 according to the invention. In this case, a fork-shaped holder, comprising two fork prongs 34 and 35, is

fastened to the cooking appliance wall 20. The fork prongs 34, 35 have contacts 25'' and 27'', which are connected to the closed-loop control unit via the lines 29, 31. The contacts 25'' and 27'' are likewise at different potentials, so that no current flow can occur between the contacts 27'' and 25'' if the cooking process probe 11 is not located inside the holder. On the other hand, when the cooking process probe 11 is inserted into the retaining device 33, a current flow occurs between the contacts 25'' and 27'' via the surface of the cooking process probe 11.

Represented in Figure 5 is a fourth retaining device 36 according to the invention. This retaining device 36 comprises annular holders 37 and 39. By contrast with the holders represented in Figures 2 to 4, the holders 37 and 39 have no contacts, but sensors 41 and 43, which are connected to the closed-loop control unit of the cooking appliance 1 via a line 45, are arranged on one holder 39. The sensors 41 and 43 comprise reed contacts, which are closed when the cooking process probe 11 is inserted with its tip through the holder 37 into the holder 39. The closing of the reed contacts has the effect for the method according to the invention of detecting that the cooking process probe 11 is located in the retaining device 36.

Represented in Figure 6 is a fifth retaining device 47 according to the invention. This retaining device 47 comprises two fork-shaped holders 49, 51, into which the cooking process probe 11 can be clipped. Arranged between the holders 49 and 51 is a sensor 53. When the cooking process probe 11 is inserted into the holder 49 or 51, this closes the contact of the sensor 53, which is connected to the closed-loop control unit of the cooking appliance via a line 55. Closing of the contact means that the cooking process probe 11 is located in the holder 47

The insertion of the cooking process probe 11 into the positioning device 15 represents a second desired action for handling the cooking process probe 11. This is so because, if when the positioning device 15 is being used the cooking process probe 11 is not inserted into it, improper use of the cooking process probe 11 can likewise be concluded.

Furthermore, improper use of the cooking process probe 11 can be concluded if the cooking process probe 11 is not moved in the time period in which the cooking chamber door 5 is open, the item being cooked 13 is introduced into the cooking chamber 3 and the cooking chamber door 5 is closed, since a corresponding movement represents a third desired handling action. It is then to be assumed that, although the cooking process probe 11 is inside the cooking chamber 3, it is outside the item being cooked 13. Monitoring of the movement of the cooking process probe 11 may take place either by means of a movement sensor (not shown) arranged in the cooking process probe 11 or an electronic locating system for the cooking process probe 11 (not shown) arranged in the cooking appliance 1. Such a locating system also makes it possible in principle to establish whether the cooking process probe 11 is located inside or outside the cooking chamber 3.

A fourth desired handling action is that of grasping the cooking process probe 11, which likewise allows conclusions to be drawn concerning improper use of the cooking process probe 11. To detect this desired handling action, the cooking process probe 11 may comprise, for example, a conductivity sensor (not shown), which makes it possible to establish grasping of the cooking process probe 11 by a user. If such grasping does not occur, for example during the time

period in which the cooking chamber door 5 is open, it can likewise be assumed that the cooking process probe 11 has not been inserted into the item being cooked 13.

Also represented in Figure 7 is a cooking process probe 11' according to the invention, which comprises a number of temperature sensors (not represented) in its needle-shaped tip 57 and has a conductivity sensor 61 arranged on its recessed grip 59. If a user grasps the cooking process probe 11' at the recessed grip 59, he touches the conductivity sensor 61, which then detects a change in conductivity. This leads to a detection of grasping of the cooking process probe 11', which can be processed in the method according to the invention.

The cooking process probe can advantageously be cooled by means of a cooling device (not represented), in order to make grasping of the recessed grip 59 more comfortable and/or to avoid an item being cooked being damaged by insertion of a hot needle-shaped tip 57.

According to the invention, it may also be provided that the positioning device 15 has at least one of the design features represented in the exemplary embodiments of the retaining device.

Consequently, by monitoring various desired handling actions or mishandling actions, in particular of the cooking process probe 11, the method according to the invention makes it possible to detect improper use, in particular non-insertion, of the same.

The features of the invention disclosed in the above description, in the drawings and in the claims may be essential both individually and in any desired combination for the invention to be realized in its various embodiments.

List of designations

1	cooking appliance
3	cooking chamber
5	cooking chamber door
7	input unit
9	output unit
11,11'	cooking process probe
13	item being cooked
15	positioning device
16	accessory part
17,17'	retaining device
19	cable
20	cooking appliance wall
21,21'	holder
23,23'	holder
25,25',25''	contact
27,27',27''	contact
29	line
31	line
32	retaining device
33	retaining device
34	fork prong
35	fork prong
36	retaining device
37	holder
39	holder
41	sensor
43	sensor
45	line
47	retaining device
49	holder
51	holder
53	sensor
55	line
57	tip
59	recessed grip
61	conductivity sensor

Claims

1. A method for conducting a cooking process in a cooking chamber of a cooking appliance using a cooking process probe which is to be inserted at least partly into an item being cooked in the cooking chamber for detecting at least one variable of the item being cooked, in which method non-insertion of the cooking process probe into the item being cooked is detected and, if non-insertion is detected, at least a first warning signal is emitted, a changeover is made to an emergency program and/or the cooking program is aborted, characterized in that

to detect non-insertion of the cooking process probe, a monitoring is carried out to determine whether

- the cooking process probe is in a standby position in a retaining device provided by the cooking appliance,
- the cooking process probe has been removed from the retaining device,
- the cooking process probe is in a measuring position in a positioning device provided by an accessory part for receiving the item being cooked,
- the cooking process probe has been removed from the positioning device,
- the cooking process probe is positioned inside the cooking appliance,
- the cooking process probe has been moved, and/or
- the cooking process probe has been grasped.

2. The method as claimed in claim 1, characterized in that, to detect non-insertion of the cooking process probe, a monitoring is carried out to determine whether the cooking process probe is connected to the cooking appliance.

3. The method as claimed in claim 1 or 2, characterized in that, at at least one predetermined point in time, preferably determined by the beginning of a cooking process, the end of a cooking process and/or an actuation, in particular opening or closing, of a cooking chamber door, the monitoring to detect non-insertion of the cooking process probe proceeds automatically.

4. The method as claimed in one of the preceding claims, characterized in that, in an monitoring to detect non-insertion, at least a conductivity value, a resistance value, an induction value, a capacitance value, a potential difference value, a temperature value, a weight value, a moisture value, a radiation characteristic, a pressure characteristic and/or a characteristic of an electric, magnetic or electromagnetic field is or are detected, in particular over time and/or by forming time derivatives.

5. The method as claimed in one of the preceding claims, characterized in that, to detect non-insertion of the cooking process probe, at least one variable of the item being cooked detected by means of the cooking process probe, a variation over time of the variable of the item being cooked and/or at least one derivative of the variation over time of the variable of the item being cooked is or are determined with respect to time, the determined variable of the item being cooked, the determined variation over time and/or the determined derivative preferably being compared with at least one setpoint value.

6. The method as claimed in one of the preceding claims, characterized in that, dependent on the

cooking process, a second warning signal is emitted if the cooking process probe is not placed in the retaining device, in order to call on an operator to place the cooking process probe in the retaining device, and/or a third warning signal is emitted if the cooking process probe is not placed in the positioning device, in order to call on an operator to place the cooking process probe in the positioning device.

7. A cooking appliance (1) for carrying out a method as claimed in one of the preceding claims, characterized by at least one sensor for detecting non-insertion of the cooking process probe (11, 11'), in particular comprising electrical contacts (25, 25', 25'', 27, 27', 27''), a contact sensor, a pressure sensor, a light barrier, an ultrasonic sensor, a reed contact (41, 43, 53), a locating system, preferably operating electromagnetically, a movement sensor, a light sensor, a conductivity sensor (61) and/or a moisture sensor.

8. The cooking appliance as claimed in claim 7, characterized in that the sensor (25, 25', 25'', 27, 27', 27'', 41, 43, 53, 61) is comprised by the retaining device (17, 17', 32, 33, 36, 47), the positioning device (15) and/or the cooking process probe (11, 11').

9. The cooking appliance as claimed in claim 7 or 8, characterized by an input (7) and/or output unit (9) and/or an open-loop and/or closed-loop control unit in operative connection with the cooking process probe (11, 11'), a cooking chamber door (5), the sensor (25, 25', 25'', 27, 27', 27'', 41, 43, 53, 61), the retaining device (17, 17', 32, 33, 36, 47) and/or the positioning device (15).

10. The cooking appliance as claimed in one of claims 7 to 9, characterized in that the cooking process probe (11, 11') is captively connected to the cooking appliance (1).

11. The cooking appliance as claimed in one of claims 7 to 10, characterized by a cooling device, at least temporarily in operative connection with the cooking process probe (11, 11') and/or the retaining device (17, 17', 32, 33, 36, 47), for cooling of at least one region of the cooking process probe (11, 11').